I. A SYNTHESIS OF PINASTRINIC ACID
II. STUDIES OF THE REDUCTION PRODUCT OF DIMETHYL-β-(2-NITRO-3-THIENYL)ETHYLAMINE

BY

WILLIAM WARREN WEST

B.A., Knox College, 1943

M.S., University of Illinois, 1950

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN CHEMISTRY
IN THE GRADUATE COLLEGE OF THE UNIVERSITY
OF ILLINOIS, 1952

URBANA, ILLINOIS
1952

I. A SYNTHESIS OF PINASTRINIC ACID
II. STUDIES OF THE REDUCTION PRODUCT OF DIMETHYL-β-(2-NITRO-3-THIENYL)ETHYLAMINE

BY

WILLIAM WARREN WEST

B.A., Knox College, 1943

M.S., University of Illinois, 1950

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN CHEMISTRY
IN THE GRADUATE COLLEGE OF THE UNIVERSITY
OF ILLINOIS, 1952

URBANA, ILLINOIS
1952

ACKNOWLEDGMENT

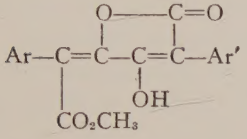
The author wishes to express his sincere gratitude to Dr. Harold R. Snyder and Dr. Robert L. Frank for suggesting these investigations and for their guidance and encouragement.

The author is grateful to the University of Illinois for a research assistantship from February, 1950, to February, 1952.

I. A SYNTHESIS OF PINASTRINIC ACID

INTRODUCTION

Several substituted pulvinic acid and pulvinic acid lactone derivatives occur naturally as lichen pigments. One of these substances, pinastrinic acid (I), is found in the lichens *Cetraria pinastri* and *Cetraria juniperina*. The structure of pinastrinic acid has been established by means of degradation and reduction studies and by syntheses. (1) (2)



(I) Ar = phenyl, Ar′ = *p*-methoxyphenyl

(II) Ar = *p*-methoxyphenyl, Ar′ = phenyl

The purpose of the work reported here was to synthesize pinastrinic acid by a procedure involving modifications of the methods of Shildneck and Adams (3) and Frank, Clark and Coker (4).

DISCUSSION OF RESULTS

2-(*p*-Methoxyphenyl)-1, 4-benzoquinone was prepared by the coupling reaction between *p*-methoxybenzenediazonium chloride and benzoquinone. Treatment of the monoarylquinone with excess benzene, aluminum chloride and stannic chloride afforded 2-(*p*-methoxyphenyl)-5-phenyl-1, 4-benzoquinone which was reduced to the hydroquinone with zinc and acetic acid. 2-(*p*-methoxyphenyl)-5-phenyl-3, 6-dibromo-1, 4-hydroquinone, prepared by the bromination of this hydroquinone, could be readily oxidized to the quinone by nitrous acid. Hydrolysis of the dibromoquinone with methanol and sodium hydroxide yielded 2-(*p*-methoxyphenyl)-5-phenyl-3, 6-dihydroxy-1, 4-benzoquinone.

Lead tetraacetate oxidation of the last compound produced *p*-methoxypulvinic acid lactone. Cleavage of the dilactone structure by refluxing with a mixture of methanol and hydrochloric acid yielded two compounds, pinastrinic acid (I) and an isomer of pinastrinic acid ($C_{20}H_{16}O_6$), melting at 129.5-130°. The formation of the isomer, probably represented by structure (II), has not been observed previously; its possible occurrence in nature is pointed out.

BIBLIOGRAPHY

1. Koller and Klein, Monatsh., **63**, 213-15 (1934).
2. Asano and Kameda, Ber., **67B**, 1522-6 (1934).
3. Shildneck and Adams, J. Am. Chem. Soc., **53**, 2373 (1931).
4. Frank, Clark and Coker, J. Am. Chem. Soc., **72**, 1824 (1950).

R. UNIV. BIBLIOTHEEK LEIDEN

II. STUDIES OF THE REDUCTION PRODUCT OF DIMETHYL-β-(2-NITRO-3-THIENYL)ETHYLAMINE

INTRODUCTION

Recent work by Swaminathan (1) has shown that one of the most promising general methods for the synthesis of thiopheno-2, 3:2′, 3′-pyrrole (a potential antibacterial agent) consists of the following steps: (A) extension of the carbon chain length in 3-methylthiophene by one carbon; (B) introduction of a nitro group into the 2-position, either before or after (A); (C) reductive cyclization to a dihydroindole and (D) dehydrogenation of the dihydroindole.

The aim of the present work was to determine the structure of a possible intermediate in a synthesis of this type, *viz.* the structure of the reduction product of dimethyl-β-(2-nitro-3-thienyl) ethylamine.

DISCUSSION OF RESULTS

Low temperature nitration of 3-methylthiophene afforded a mixture of 2-nitro-3-methylthiophene and 5-nitro-3-methylthiophene. Reaction of the 2-nitro isomer with an aqueous solution of formaldehyde and dimethylamine produced dimethyl-β-(2-nitro-3-thienyl) ethylamine. Reduction of this Mannich base with tin and hydrochloric acid formed the stannic salt of an amine which was investigated as a possible intermediate in the synthesis of thiopheno-2, 3:2′, 3′-pyrrole.

Treatment of the stannic salt of the reduction product with aqueous sodium hydroxide liberated a free amine which proved to be very unstable, as were the derivatives which were made from this amine in an attempt to characterize it. It is likely that the reduction product was either 2-amino-3-ethylthiophene or 4′, 5′-dihydro-thiopheno-2, 3:2′, 3′-pyrrole. Even if the structure is correctly represented by the latter formula, it would seem that the feasibility of the remaining dehydrogenation step may be seriously curtailed by stability factors.

BIBLIOGRAPHY

1. Swaminathan, Ph.D. Thesis, University of Illinois (1949).

VITA

The author was born in Galesburg, Illinois, on September 11, 1922. He graduated from high school in 1940 and in 1943 received the degree of Bachelor of Arts from Knox College, Galesburg, Illinois. He served in the United States Navy from April, 1944, to February, 1946. In September, 1948, he entered the Graduate College of the University of Illinois and received the degree of Master of Science in February, 1950. From February, 1950, until February, 1952, he held a half-time research assistantship in organic chemistry.